

REMARKS

Claims 1-6 and 8-13 were pending. The Office Action rejected claims 1-6 and 8-13. The present amendment cancels claims 106 and adds new claims 15-20. If the present amendment is entered, claims 8-13 and 15-20 will be pending.

Claims 1-6 and 8-13 were rejected under 35 U.S.C. §103 as being unpatentable over Applicants' alleged admitted prior art (AAPA) in view of U.S. Patent Application Publication No. 2002/0115283 (Ho) and in view of U.S. Patent No. 6,706,166 to Chou et al. (Chou). Additionally, claims 1-6 and 8-13 were rejected under 35 U.S.C. §103 as being unpatentable over AAPA in view of Ho and U.S. Patent No. 6,176,992 to Talieh (Talieh). Claims 1-6 are canceled. Applicants' respectfully traverse the rejections of claims 8-13.

Claim Amendments

The present amendment cancels claims 1-6 and adds new claims 15-20. Claim 15 is similar to claim 8, but recites "performing a copper electroplating process in an electroplating apparatus to fill the damascene patterns with a copper layer by applying a negative (-) power supply to the substrate," "changing a bias condition by turning off the negative (-) power supply and applying a positive (+) power supply to the copper layer and the copper barrier layer in the electroplating apparatus," and "polishing the copper layer and the copper seed layer by means of a copper electro-polishing process in the electroplating apparatus until the copper barrier metal layer is exposed, thereby forming copper wirings within the damascene patterns." New claims 16-20 depend from claim 15 and recite elements similar to those recited in claims 9-13.

Entry of the amendment is respectfully requested.

Rejections under 35 U.S.C. §103

The Office Action failed to establish a prima facie case that either the hypothetical combination of AAPA, Ho, and Chou, or the hypothetical combination of AAPA, Ho, and Talieh, renders claim 8 unpatentable. In particular, the Office Action failed

to establish that the hypothetical combinations of AAPA, Ho, and Chou and AAPA, Ho, and Talieh teach, disclose or suggests all the elements of the claims.

Claim 8, for example, is directed generally to a method of forming a copper wiring in a semiconductor device. Claim 8 recites, *inter alia*, “polishing the copper layer and the copper seed layer by means of a copper electro-polishing process in the electroplating apparatus by turning off the negative (-) power supply and applying a positive (+) power supply to the copper layer and the copper barrier layer until the copper barrier metal layer is exposed, thereby forming copper wirings within the damascene patterns.”

The Office Action admitted that the AAPA does not disclose polishing the copper layer by means of a copper electro-polishing process. The Office Action alleged that, Ho discloses polishing the copper layer by means of a copper electro-polishing process, but admitted that Ho does not disclose “polishing the copper layer and the copper seed layer by means of a copper electro-polishing process in the electroplating apparatus by turning off the negative (-) power supply and applying a positive (+) power supply ...”

The Office Action then alleged that this element is disclosed by Chou. Specifically, the Office Action alleged that Chou “discloses utilizing a single apparatus to perform an electroplating process and an electro polishing process by changing the negative power supply to a positive power supply.” *Office Action* at p. 8. Additionally, the Office Action alleged that this element is disclosed by Talieh.

But none of the applied references teaches, discloses or suggests the combination of “performing a copper electroplating process in an electroplating apparatus to fill the damascene patterns with a copper layer by applying a negative (-) power supply to the substrate” and “polishing the copper layer and the copper seed layer by means of a copper electro-polishing process in the electroplating apparatus by turning off the negative (-) power supply and applying a positive (+) power supply to the copper layer and the copper barrier layer until the copper barrier metal layer is exposed, thereby forming copper wirings within the damascene patterns.” For example, Ho merely states that a Cu layer is “rendered anodic” by “current [] passed through the system” during a polishing step. *Ho* at par. [0038]. But Ho teaches nothing about polishing by turning off a negative power supply applied to a substrate, and applying a positive power supply to a copper layer and a copper barrier layer.

Chou describes reversing a potential applied to a "plating surface" of a semiconductor wafer during an electroplating process. *See Chou* at col. 2, line 42 to col. 3, line 4. But Chou does not disclose polishing by turning off a negative power supply applied to a substrate, and applying a positive power supply to a copper layer and a copper barrier layer as recited in claim 8.

Talieh describes applying a negative potential to a cathode and applying a positive potential to an anode during a combined deposition and polishing step related to a metal layer. *See Talieh* at col. 4, line 61 to col. 5, line 15. After this step, the polarities of the cathode and anode can be reversed during a seed layer polishing step. *See Talieh* at col. 5, lines 16-32. Thus, Talieh does not disclose "polishing the copper layer and the copper seed layer by means of a copper electro-polishing process in the electroplating apparatus by turning off the negative (-) power supply and applying a positive (+) power supply to the copper layer and the copper barrier layer until the copper barrier metal layer is exposed, thereby forming copper wirings within the damascene patterns."

Thus, the Office Action failed to establish that the applied references teach, disclose, or suggest all the elements of claim 8. Accordingly, withdrawal of the rejection is respectfully requested.

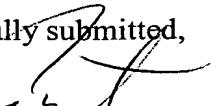
With regard to claims 9-13, which depend from claim 8, it is submitted that these claims are allowable at least for the same reasons as claim 8.

Conclusion

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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